

# EXERCISES

For more practice, see *Extra Practice*.

## Practice and Problem Solving

### **A** Practice by Example

#### Example 1 (page 264)

Write the negation of each statement.

1. Two angles are congruent.
2. You are not sixteen years old.
3. The angle is not obtuse.
4. The soccer game is on Friday.
5. The figure is a triangle.
6.  $m\angle A < 90$

#### Example 2 (page 265)

Write (a) the inverse and (b) the contrapositive of each conditional statement.

7. If you eat all of your vegetables, then you will grow.
8. If a figure is a square, then all of its angles are right angles.
9. If a figure is a rectangle, then it has four sides.

#### Example 3 (page 266)

**Developing Proof** Write the first step of an indirect proof.

10. It is raining outside.
11.  $\angle J$  is not a right angle.
12.  $\triangle PEN$  is isosceles.
13. At least one angle is obtuse.
14.  $\overline{XY} \cong \overline{AB}$
15.  $m\angle 2 > 90$

#### Example 4 (page 266)

**Developing Proof** Identify the two statements that contradict each other.

16. I.  $\triangle PQR$  is equilateral.  
II.  $\triangle PQR$  is a right triangle.  
III.  $\triangle PQR$  is isosceles.
17. I. In right  $\triangle ABC$ ,  $m\angle A = 60$ .  
II. In right  $\triangle ABC$ ,  $\angle A \cong \angle C$ .  
III. In right  $\triangle ABC$ ,  $m\angle B = 90$ .
18. I.  $\ell$  and  $m$  are skew.  
II.  $\ell$  and  $m$  do not intersect.  
III.  $\ell \parallel m$
19. I. Each of the two items that Val bought costs more than \$10.  
II. Val spent \$34 for the two items.  
III. Neither of the two items that Val bought costs more than \$15.

#### Example 5 (page 266)

20. **Developing Proof** Fill in the blanks to prove the following statement.  
If the Debate and Chess Clubs together have fewer than 20 members and the Chess Club has 10 members, then the Debate Club has fewer than 10 members.

**Given:** The total membership of the Debate Club and the Chess Club is fewer than 20. The Chess Club has 10 members.

**Prove:** The Debate Club has fewer than 10 members.

**Proof:** Assume that the Debate Club has 10 or more members.

This means that together the two clubs have **a.** ? members.

This contradicts the given information that **b.** ?.

The assumption is false. Therefore it is true that **c.** ?.



### Reading Math

For help with reading and solving Exercise 21, see p. 271.

- 21. Developing Proof** Fill in the blanks to prove the following statement.  
In a given triangle,  $\triangle LMN$ , there is at most one right angle.

**Given:**  $\triangle LMN$

**Prove:**  $\triangle LMN$  has at most one right angle.

**Proof:** Assume that  $\triangle LMN$  has more than one **a.** ?. That is, assume that both  $\angle M$  and  $\angle N$  are **b.** ?. If  $\angle M$  and  $\angle N$  are both right angles, then  $m\angle M = m\angle N = \mathbf{c.}$  ?. By the Triangle Angle-Sum Theorem,  $m\angle L + m\angle M + m\angle N = \mathbf{d.}$  ?. Use substitution to find  $m\angle L + \mathbf{e.}$  ?  $+ \mathbf{f.}$  ?  $= 180$ . When you solve for  $m\angle L$ , you find that  $m\angle L = \mathbf{g.}$  ?. This means that there is no  $\triangle LMN$ , which contradicts the given statement. So the assumption that  $\triangle LMN$  has **h.** ? must be false. Therefore,  $\triangle LMN$  has **i.** ?.

### B Apply Your Skills

**Write (a) the inverse and (b) the contrapositive of each statement. Give the truth value of each.**

- 22.** If you live in Sarasota, then you live in Florida.

- 23.** If four points are collinear, then they are coplanar.

**Open-Ended** Write a true conditional statement for each given condition. If such a statement is not possible, tell why.

- 24.** The inverse is false.

- 25.** The inverse is true.

- 26.** The contrapositive is false.

- 27.** The contrapositive is true.

- 28. Error Analysis** Angie saw an ad that stated “If you don’t drink Muscle Rex, then you won’t build muscles.” Angie bought Muscle Rex and drank it, and nothing happened. She sent an e-mail to the company asking for her money back. The company would not refund her money. They claimed that her reasoning was faulty. Using one or more of the terms *converse*, *inverse*, or *contrapositive*, explain why Angie’s reasoning was faulty.



**Writing** For Exercises 29–32, write a convincing argument that uses indirect reasoning.

- 29.** Fresh skid marks appear behind a green car at the scene of an accident. Show that the driver of the green car applied the brakes.

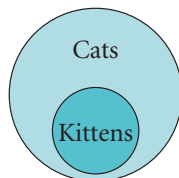
- 30.** Ice is forming on the sidewalk in front of Toni’s house. Show that the temperature of the sidewalk surface must be 32 F or lower.

- 31.** An obtuse triangle cannot contain a right angle.

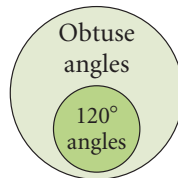
- 32.** In a plane, a line has no more than one perpendicular at any of its points.

**Write the conditional statement illustrated by each Venn diagram. Then write its contrapositive.**

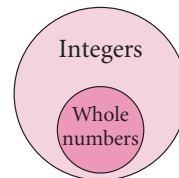
**33.**



**34.**



**35.**



- 36. Open-Ended** Describe a real-life situation in which you used an indirect argument to convince someone of your point of view. Outline your argument.



### Need Help?

To review Venn diagrams, see page 69.

37. Earl lives near a noisy construction site at which work ends promptly at 5:00 each workday. Earl thinks, “Today is Tuesday. If it were before 5:00, I would hear construction noise, but I don’t hear any. So it must be later than 5:00.”
- What does Earl prove?
  - What assumption does he make?
  - What fact would contradict the assumption?



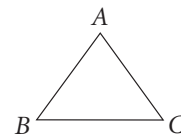
38. **Literature** In Arthur Conan Doyle’s story “The Sign of the Four,” Sherlock Holmes talks to his friend Watson about how a culprit enters a room that has only four entrances: a door, a window, a chimney, and a hole in the roof.
- “You will not apply my precept,” he said, shaking his head. “How often have I said to you that when you have eliminated the impossible, whatever remains, however improbable, must be the truth? We know that he did not come through the door, the window, or the chimney. We also know that he could not have been concealed in the room, as there is no concealment possible. Whence, then, did he come?”
- How did the culprit enter the room? Explain.



- Challenge** **Proof** 39. Use indirect reasoning to prove the following.

**Given:**  $\triangle ABC$  with  $BC > AC$

**Prove:**  $\angle A \neq \angle B$



- Proof** 40. Write an indirect proof.

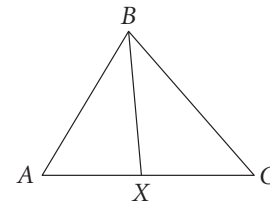
**Given:**  $\triangle XYZ$  is isosceles.

**Prove:** Neither base angle is a right angle.

- Proof** 41. Write an indirect proof.

**Given:**  $\triangle ABC$  is scalene,  $m\angle ABX = 36$ ,  
and  $m\angle CBX = 36$ .

**Prove:**  $\overline{XB}$  is not perpendicular to  $\overline{AC}$ .





## Standardized Test Prep

### Multiple Choice

42. What is the negation of  $x \leq 10$ ?  
 A.  $x \leq -10$       B.  $-x \leq 10$       C.  $-x > 10$       D.  $x > 10$
43. What is the negation of  $y > 8$ ?  
 F.  $y \leq -8$       G.  $y \leq 8$       H.  $-y > 8$       I.  $y > 8$
44. What is the inverse of  $p \rightarrow q$ ?  
 A.  $q \rightarrow p$       B.  $\sim q \rightarrow \sim p$       C.  $p \rightarrow q$       D.  $\sim p \rightarrow \sim q$
45. What is the contrapositive of the following statement?  
 If two parallel lines are cut by a transversal, then the corresponding angles are congruent.  
 F. If two lines are cut by a transversal and the corresponding angles are congruent, then the two lines are parallel.  
 G. If two nonparallel lines are cut by a transversal, then the corresponding angles are not congruent.  
 H. If two lines are cut by a transversal and the corresponding angles are not congruent, then the two lines are not parallel.  
 I. If two parallel lines are cut by a transversal, then the corresponding angles are not congruent.
46. Use indirect reasoning to give a convincing argument that an obtuse triangle has at most one obtuse angle.



### Take It to the NET

Online lesson quiz at  
[www.PHSchool.com](http://www.PHSchool.com)  
 Web Code: afa-0504

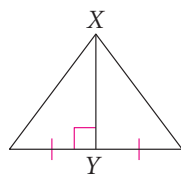
### Short Response

## Mixed Review

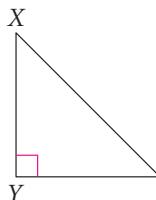
### Lesson 5-3

Is  $\overline{XY}$  a perpendicular bisector, an angle bisector, an altitude, a median, or none of these? Explain.

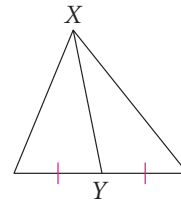
47.



48.



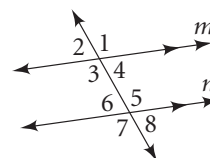
49.



### Lesson 3-1

Classify each pair of angles as *alternate interior angles*, *same-side interior angles*, or *corresponding angles*.

50.  $\angle 1$  and  $\angle 5$       51.  $\angle 4$  and  $\angle 5$   
 52.  $\angle 3$  and  $\angle 5$       53.  $\angle 3$  and  $\angle 7$



### Lesson 2-4

Use the given property to complete each statement.

54. Addition Property of Equality  
 If  $5x - 10 = 25$ , then  $5x = \underline{\hspace{1cm}}$ .
55. Symmetric Property of Equality  
 If  $m\angle ABC = 45$ , then  $\underline{\hspace{1cm}}$ .

# Geometry at Work

## .....Industrial Designer

**Industrial** designers work on two-dimensional surfaces to develop products that have three-dimensional appeal to consumers. They use computer-aided design (CAD) software to create two-dimensional screen images and manipulate them for three-dimensional effects. Fashion designers use CAD to study their creations on electronic human forms from various angles and distances.



**Take It to the NET** For more information about industrial design go to **[www.PHSchool.com](http://www.PHSchool.com)**.  
Web Code: afb-2031